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# A SYNOPSIS OF THE SOUTH AMERICAN SPECIES OF *PHYLLOGOMPHOIDES*, WITH A KEY AND DESCRIPTIONS OF THREE NEW TAXA (ODONATA, GOMPHIDAE)

by

JEAN BELLE
*Onder de Beumkes 35, Velp, the Netherlands*

## Abstract

A synopsis is given of the 25 representatives of the genus *Phyllogomphoides* Belle known from South America. The species are classified into eight groups, and a key to these species is given. Three taxa are introduced as new, viz., *Ph. major* (♂ holotype and ♀ allotype: Surinam River, Surinam), *Ph. pedunculus* (♂ holotype: Rio Uaupés, Amazonas, Brazil), and *Ph. pseudoundulatus* (♂ holotype: Rio Tapajós (Cachoeira I), Pará, Brazil). Descriptive and corrective notes on some of the previously described species are offered. The holotypes of *Gomphoides fuliginosa* Hagen *in* Selys and *Gomphoides audax* Hagen *in* Selys have been restudied. A neotype has been designated for *Gomphoides selysi* Navás and the female is described for the first time.

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## Introduction

The genus *Phyllogomphoides* Belle, 1970, comprises about forty species distributed all over the tropical parts of the New World, ranging from South Brazil, Paraguay and Bolivia northward through Central America to the southern and western borders of Texas in the USA. The species are predominantly forest dwellers, which avoid cultivated areas. Although little is known of the ecology of any of the species, such field observations as have been recorded indicate that their larvae live in the small and large streams which cross the forests. Most of the males stay near the banks of the streams which gave them birth, but the females move into the forest and visit only again their parent streams for ovipositing. Hence females are particularly rare in collections. Of the 25 species known from South America, the females of nine and the males of three species are unknown. Our knowledge of the genus is decidedly scanty and it is virtually certain that several species wait to be discovered in the extensive jungles of the area involved. As Donnelly (1979) recently treated the Central American representatives of this genus, I have confined myself to the South American congeners in order to avoid reiterations. Also it seems unnecessary to recapitulate the generic characters of *Phyllogomphoides* since it has recently been compared with *Gomphoides* by Gloyd (1973) and Belle (1982), and with *Idiogomphoides* by Belle (1984).

Three new taxa have been detected, bringing the number of South American representatives of *Phyllogomphoides* up to 25. These three species are here described under the specific names *major, pedunculus* and *pseudoundulatus.* A neotype for *Phyllogomphoides selysi* (Navás) is designated as it appears necessary to stabilize its identity. The previously unknown female of this species is also described.

The Comstock-Needham nomenclature for the longitudinal veins is used. With the exception of figs. 31 and 32, all illustrations are original camera lucida drawings (details completed by free hand) or have been made from photographs (wings), while the figures representing colour patterns of the labrum and the pterothorax are diagrammatic and not drawn on scale.

## Acknowledgements and disposition of material studied

I am indebted to many persons who have sent specimens on loan. The material studied for the preparation of this paper belongs to the institutions and personal collections mentioned below. The names are preceded by the acronyms used throughout the text of this paper, those of the collections in the institutions are proposed by Heppner & Lamas (1982).

AC — Author's collection.
ANSP — Academy of Natural Sciences, Philadelphia; Dr. Daniël Otte.
BMNH — British Museum (Natural History), London; Mr. Peter H. Ward.
CJ — Collection Jurzitza, Karlsruhe; Prof. Dr. Gerhard Jurzitza.
CM — Collection Machado, Belo Horizonte; Prof. Dr. Angelo B. M. Machado.
CU — Cornell University, Ithaca; Prof. Dr. L. L. Pechuman.
FSCA — Florida State Collection of Arthropods, Gainesville; Prof. Dr. Minter J. Westfall, Jr.
IRSN — Institut Royal des Sciences Naturelles, Brussels; Dr. Georges Demoulin.
UCV — Instituto de Zoología Agrícola, Universidad Central de Venezuela, Maracay; Dr. Janis Rácenis (†) and Mr. Jorge De Marmels.
MCZ — Museum of Comparative Zoology, Harvard University, Cambridge; Mr. Charles Vogt.
RNHL — Rijksmuseum van Natuurlijke Historie, Leiden; Dr. Pieter H. van Doesburg.
USNM — National Museum of Natural History (formerly United States National Museum), Smithsonian Institution, Washington, D.C.; Dr. Oliver S. Flint, Jr.
NHMV — Naturhistorisches Museum, Vienna; Dr. A. Kaltenbach.
SMF — Senckenberg Museum, Frankfurt-am-Main; Dr. Heinz Schröder.
UMAA — University of Michigan, Ann Arbor; Dr. T. W. Moore.
ZMHB — Zoologisches Museum, Humboldt Universität, East Berlin; Dr. Kurt K. Günther.
ZMUH — Zoologische Institut und Zoologisches Museum, Universität von Hamburg, Hamburg; Prof. Dr. H. Strümpel.

Valuable information and help were also given by Mr. Carl Cook (Center), Dr. M. G. Emsley (Philadelphia), Mrs. Leonora K. Gloyd (Ann Arbor), and Dr. Jean Legrand (Paris).

## Systematic section

The genus *Phyllogomphoides* belongs to the Gomphoidinae, together with the genera *Progomphus, Aphylla, Phyllocycla, Gomphoides,* and *Idiogomphoides.* It is a rather heterogeneous unit which is readily separated from *Progomphus* in having the male anal triangle in the hind wing reaching the hind angle of the wing, from *Aphylla* by the presence of two long flagellae at the glans of the penis, from *Phyllocycla* in not having the outer side of these flagellae fringed with microscopic serratures, and from *Gomphoides* and *Idiogomphoides* in having, in the hind wing of the male, vein A2, or a branch of it, convergent with vein A3 towards the wing margin. The larvae of *Phyllogomphoides* exhibit considerable differences in the structure of their labia, and there seems to exist some parallelism with the morphology of the adult dragonfly. Based on these labial structures the genus is divisable into at least three sections (cf. Belle, 1982). In the present study the species are divided into eight infrageneric groups, the proposed groupings being based on similarities found in the form of the caudal appendages and accessory genitalia of the adult male and the labium of the larva. I am well aware that this division must be considered provisional. At this stage, it is difficult to determine the natural position of these groups within the genus since a given group frequently appears to display close relationships with several other groups. For the purpose of identification, however, it is more convenient to keep the adults united and combine them in one key. The species have several characters in common but the great diversity in the male caudal appendages and the genital organs shows that they are not all closely related. This variety is sufficiently indicated in the key to the species.

Separate keys have been prepared for the determination of males and females. The keys should be used with caution as a number of species is known only from a single specimen or from one sex. Identifications should always be checked against the complete descriptions.

The groups have been treated in such a sequence as to allow expression of apparent relationships. Within each group, however, the species are treated chronologically. For each species are given a list of references, drawings and locality records, the new material studied, and a description or descriptive notes. References without comments or critical remarks have been omitted.

Table 1 lists all species presently known from South America, including the new taxa introduced in the present paper.

## KEY TO THE SOUTH AMERICAN SPECIES OF *PHYLLOGOMPHOIDES*

### Males

(The males of *audax*, *cornutifrons*, and *praedatrix* are unknown)

1. Anterior hamules conch-shaped .......... .............................. *singularis*
— Anterior hamules of other structure ..... 2
2. Superior caudal appendages, in dorsal view, tweezers-shaped; each appendage more or

Table 1. — Alphabetic list of names of the South American species of *Phyllogomphoides*, with type status and type location.

| Species | Type | | | | | |
|---|---|---|---|---|---|---|
| | holo | lecto | lost | neo | sex | location |
| 1. *aculeus* Belle, 1982 | X | | | | ♂ | UMAA |
| 2. *andromeda* (Selys, 1869) | X | | | | ♀ | IRSN |
| 3. *angularis* Belle, 1982 | X | | | | ♂ | UMAA |
| 4. *annectens* (Selys, 1869) | | X | | | ♂ | IRSN |
| 5. *atlanticus* (Belle, 1970) | X | | | | ♂ | RNHL |
| 6. *audax* (Hagen *in* Selys, 1854) | X | | | | ♀ | ZMHB |
| 7. *brunneus* Belle, 1981 | X | | | | ♂ | FSCA |
| 8. *calverti* (Kirby, 1897) | X | | | | ♂ | BMNH |
| 9. *camposi* (Calvert, 1909) | X | | | | ♂ | ANSP |
| 10. *cassiopeia* (Belle, 1975) | X | | | | ♂ | USNM |
| 11. *cepheus* Belle, 1980 | X | | | | ♂ | CM |
| 12. *cornutifrons* (Needham, 1944) | X | | | | ♀ | CU |
| 13. *cristatus* (Needham, 1944) | X | | | | ♂ | CU ? |
| 14. *fuliginosus* (Hagen *in* Selys, 1854) | X | | | | ♀ | MCZ |
| 15. *imperator* Belle, 1976 | X | | | | ♀ | UCV |
| 16. *lieftincki* (Belle, 1970) | X | | | | ♂ | RNHL |
| 17. *major* spec. nov. | X | | | | ♂ | RNHL |
| 18. *pedunculus* spec. nov. | X | | | | ♂ | CM |
| 19. *praedatrix* Belle, 1982 | X | | | | ♀ | UMAA |
| 20. *pseudoundulatus* spec. nov. | X | | | | ♂ | SMF |
| 21. *regularis* (Selys, 1873) | X | | | | ♂ | IRSN |
| 22. *selysi* (Navás, 1924) | (X) | | X | X | ♂ | ANSP |
| 23. *semicircularis* (Selys, 1854) | X | | | | ♂ | IRSN |
| 24. *singularis* Belle, 1979 | X | | | | ♂ | FSCA |
| 25. *undulatus* (Needham, 1944) | X | | | | ♂ | CU |

less straight over whole length but slightly curving inward near apex . . . . . . . . . . . . . 3

— Superior caudal appendages, in dorsal view, forcipate; each appendage strongly curving inward . . . . . . . . . . . . . . . . . . . . . . . . . . . . 5

3. Pale collar of thoracic dorsum and second pale antehumeral stripes absent or vestigial . . . . . . . . . . . . . . . . . . . . . . . . . . . *andromeda*

— These stripes well-developed . . . . . . . . . . . 4

4. Face green with black band along free border of labrum . . . . . . . . . . . . . . . . . *cassiopeia*

— Face black with green markings on clypeus and labrum . . . . . . . . . . . . . . . . . . . . *cepheus*

5. Anterior hamules of very complicated form, with bulbous frontal part, lateral leaf-like expansion, and backwardly elongated apex . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 6

— Anterior hamules of more simple structure . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 9

6. Inferior caudal appendage very short and deeply excised V-shaped . . . . . . . . . . . *major*

— Inferior caudal appendage about half as long as superiors and divided shortly beyond its base into two branches . . . . . . . . . 7

7. Second pale antehumeral stripes and pale metepisternal stripes absent or vestigial . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . *imperator*

— These stripes well-defined . . . . . . . . . . . . . 8

8. Large species; abdomen 56—57 mm (incl. caud. app.), hind wing 42 mm, costal edge of pterostigma in fore wing 5.5—5.8 mm. Pale basal marking of abdominal segment 7 covering far more than one-third of the segment . . . . . . . . . . . . . . . . . . . . . . . . . . . *selysi*

— Smaller species; abdomen 50—54 mm (incl. caud. app.), hind wing 36—37 mm, costal edge of pterostigma in fore wing 4.8—5.0 mm. Pale basal marking of abdominal segment 7 covering one-third of the segment . . . . . . . . . . . . . . . . . . . . . . . . . . . . . *fuliginosus*

9. Superior caudal appendage with two ventral processes on proximal half . . . . . . . . . . . . 10

— Superior caudal appendage without or with a single ventral process on proximal half . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 11

10. Lateral dilatations of abdominal segment 8 well-developed, leaf-like, and strongly convex . . . . . . . . . . . . . . . . . . . . . . . . . . *camposi*

— Lateral dilatations of abdominal segment 8 narrow and parallel-sided on apical half of segment . . . . . . . . . . . . . . . . . . . . . . . . *calverti*

11. Superior caudal appendage with a long, thin, finger-like basal-ventral spine . . . . . 12

— Superior caudal appendage without or with a small basal-ventral spine or tooth . . . . . 17

12. Superior caudal appendage strongly turning downward to tip, apex obtuse . . . . . . . . . 13

— Superior caudal appendage not turning downward to tip, apex acute . . . . . . . . . . 14

13. Length of penial cornua half the length of abdominal segment 3. First pale antehumeral stripe broadly confluent with pale collar (fig. 17) . . . . . . . . . . . . . . . . *pseudoundulatus*

— Length of penial cornua two-thirds the length of abdominal segment 3. First pale antehumeral stripes isolated (fig. 16) . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . *undulatus*

14. Posterior margin of anterior hamules with an acute hook. Subtriangle in hind wings uncrossed . . . . . . . . . . . . . . . . . . . . . . . . . 15

— Posterior margin of anterior hamules with an excision. Subtriangle in hind wings crossed . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 16

15. Penial peduncle (seminal vesicle) slender and excessively elongated, being about half the length of abdominal segment 2 (fig. 36) . . . . . . . . . . . . . . . . . . . . . . . . . . . *pedunculus*

— Penial peduncle shorter, being about one-third the length of abdominal segment 2 . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . *angularis*

16. Superior caudal appendage with a superior tooth at about two-thirds the length . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . *atlanticus*

— Superior caudal appendage without superior tooth . . . . . . . . . . . . . . . . . . . . . . . . *aculeus*

17. Inferior caudal appendage well-developed and divided shortly beyond its base into two branches . . . . . . . . . . . . . . . . . . . . . . 18

— Inferior caudal appendage very short and excised more or less V-shaped . . . . . . . . . 19

18. Cornua of penis distinctly shorter than median segment of penis (fig. 27). Inferior caudal appendage with bottom of excision as wide as length of either branch . . . . *regularis*

— Cornua of penis about as long as median segment of penis. Inferior caudal appendage with the length of either branch one and a half times the width of bottom of excision . . . . . . . . . . . . . . . . . . . . . . . . . . *annectens*

19. Superior caudal appendage with a superior tooth at about two-thirds the length . . . . 20

— Superior caudal appendage without superior tooth . . . . . . . . . . . . . . . . . . . . . . *cristatus*

20. Anterior hamules notched at inner margin . . . . . . . . . . . . . . . . . . . . . . . . . . . *semicircularis*

— Anterior hamules notched at posterior margin . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 21

21. Labrum with a pair of pale spots . *lieftincki*

— Labrum entirely brown . . . . . . . . . *brunneus*

Females

(The females of *aculeus, angularis, annectens, atlanticus, calverti, camposi, pedunculus, pseudoundulatus* and *singularis* are unknown)

1. Frons with a pair of large horns .......................................... *cornutifrons*
— Frons without horns .................. 2
2. Pale collar absent; first pale antehumeral stripe more or less pear-shaped oblong .................................. *andromeda*
— Pale collar present; first pale antehumeral stripe of different shape ................ 3
3. Abdominal segment 8 with distinct lateral dilatations .......................... 4
— Abdominal segment 8 without or with no evident lateral dilatations ............. 12
4. Width of lateral dilatations of abdominal segment 8 a quarter the middorsal length of segment 8 or wider (figs. 5, 8) ........... 5
— Width of lateral dilatations of abdominal segment 8 one-sixth the middorsal length of segment 8 or narrower ............... 10
5. Second pale antehumeral stripe and pale metepisternal stripe present ............ 6
— These stripes undeveloped or vestigial .................................. *imperator*
6. Labrum largely pale, with a black band along free border .............. *cassiopeia*
— Labrum with a pair of pale spots ........ 7
7. Vulvar lamina very widely excised; the excision more or less semicircular; the lobes rather narrow and bluntly tipped .................................. *praedatrix*
— Vulvar lamina not very widely excised; the lobes broad .......................... 8
8. Pterostigma 6—7 mm long; excision of vulvar lamina more or less U-shaped (fig. 12); width of lateral dilatations of abdominal segment 8 nearly half the middorsal length of segment 8 ..................... *major*
— Pterostigma 5—6 mm; excision of vulvar lamina more or less V-shaped; width of lateral dilatations of abdominal segment 8 about one-third the middorsal length of segment 8 .......................... 9
9. Large species; abdomen 55—56 mm (incl. cerci); hind wing 43 mm; lobes of vulvar lamina with projecting postero-lateral corners (fig. 10) ...................... *selysi*
— Smaller species; abdomen 51—53 (incl. cerci); hind wing 37—38 mm; lobes of vulvar lamina with round postero-lateral corners (fig. 9) ...................... *fuliginosus*
10. Large species; abdomen 50 mm (incl. cerci); hind wing 43 mm; vulvar lamina relatively small, its width about one-third the width of ninth sternum (fig. 11) .......... *audax*
— Smaller species; vulvar lamina relatively wider .............................. 11
11. Lateral dilatations of abdominal segments 8 and 9 equal in width; dorsum of prothorax with a pale twin-spot .......... *undulatus*
— Lateral dilatations of abdominal segment 8 twice as wide as that of abdominal segment 9; dorsum of prothorax entirely black .................................. *cepheus*
12. Labrum black along free border... *cristatus*
— Labrum pale, green of (reddish) brown along free border .................... 13
13. Labrum entirely (reddish) brown ...... 14
— Labrum largely pale or with a pair of pale spots .............................. 15
14. Dorsum of prothorax entirely black; vulvar lamina excised V-shaped for two-thirds its length .................... *semicircularis*
— Dorsum of prothorax with yellow twin-spot; vulvar lamina excised V-shaped for three-quarters its length ........ *brunneus*
15. Labrum (reddish) brown with a pair of pale spots ........................ *lieftincki*
— Labrum entirely or largely pale ... *regularis*

### *FULIGINOSUS* GROUP

The members of this infrageneric group are *fuliginosus, audax, selysi, imperator, praedatrix* and *major*. They are bound together by several striking features, in the adults as well as in the larvae, and there are some grounds for believing that a generic separation would be justifiable. The characters not encountered elsewhere in the genus are: (1) the regular division of both triangles and subtriangles into four cells in the fore wings and three in the hind (figs. 1—4); (2) the very peculiar conformation of the anterior genital hamule of the male (cf. Belle, 1970a: 112); (3) the aberrant form of the penial cornua, each cornus having the tip truncate and the apical margin concave (figs. 24, 25); (4) the different development of the lateral dilatations of the eighth abdominal segment in both sexes of the same species, those of the female being somewhat better developed than those of the corresponding male (from the same locality); and in the larva, (5) the striking structure of the lateral labial lobes having the inner margin smooth and slightly expanded on the apical half, and the end hook very large, sinuously pointed and sharply incurved.

The members *fuliginosus, audax, praedatrix* and *major* have the usual thoracic colour pattern but in *selysi* the pale markings are more extended and in *imperator* the second pale antehumeral stripe and pale metepisternal stripe are undeveloped or vestigial.

The members of the *fuliginosus* group are known from the Amazon Basin, Mato Grosso, and the northern coastal area of South America.

There exists a certain confusion among some members of the *fuliginosus* group. In 1894, Selys referred ten specimens of *Phyllogomphoides* from (British) Guyana to the species *fuliginosus* and *audax* but expressed doubt about the correctness of his identification because he had not seen the female holotypes of the two species (loc. cit., page 178: "Il faudrait revoir les deux types de Hagen pour arriver à une certitude à cet égard"). Since I have been favoured to examine these types, I can set forth that the gomphids which he referred to *fuliginosus* belong to an undescribed species, here introduced under the specific name *major*, while the gomphids referred to *audax* are the true *fuliginosus*.

In the original descriptions (Selys, 1854), the measurements given for *fuliginosus* are "abdomen 53 mm; hind wing 38 mm" and those of *audax* "abdomen 49 mm; hind wing 44 mm". However, in Selys & Hagen's Monographie des Gomphines of 1858 the measurements "abdomen 49 mm; hind wing 44 mm" are (incorrectly) associated with *fuliginosus* and the measurements "abdomen 53 mm; hind wing 38 mm" with *audax*. Selys, probably confused by this transposition, referred the species with the largest wings (*major*) to *fuliginosus* and the species with the smallest wings (*fuliginosus*) to *audax*, a mistake in placement that has persisted down to the present day. Selys, then, described both sexes of *major* and *fuliginosus* under the names *Gomphoides fuliginosa* and *Gomphoides audax*, respectively. Needham (1944), apparently being misled by Selys' misidentification, gave a very detailed description and illustrations of the male of *major*, in the belief that he had the true *fuliginosus* in his hands. Belle (1970a), finally, trusting the identifications of the previous authors, erected the genus *Phyllogomphoides* with *Gomphoides fuliginosa* Hagen *in* Selys, 1854, as the type species, basing his generic diagnosis on characters found in the adult male and larva of both *major* and *fuliginosus* but thinking to have before him the species *fuliginosus* and *audax*, respectively. In size, *major* approaches *audax* but in its morphology, it differs considerably from that species.

## Phyllogomphoides fuliginosus
(Hagen *in* Selys, 1854)
(figs. 1, 5, 9, 14, 20, 24, 38)

*Gomphoides fuliginosa* Selys, 1854: 74, 75 (55—56 sep.) — ♀ Essequibo, Chile = error pro Guyana (cf. Ris, 1904: 16). Selys & Hagen, 1858: 450, 451, 463, 471—474 (190, 191, 203, 211—214 sep.), pl. 11 figs. 5a—d (♀ occiput, genit. & apex abd.). Navás, 1916: 70 (key). Belle, 1970a: 112 (type species). Gloyd, 1974: 180.

*Gomphoides audax*; Selys, 1894: 176—178 (♂ ♀ Guyana).

*Phyllogomphoides audax*; Belle, 1970a: 116—119 (♂ Surinam), figs. (♂ genit., app. & apex abd.; larval struct.), pls. 15b (♂ photogr. wings), 16b (photogr. exuviae).

Material (in addition to that recorded by Belle, 1970a under *audax*). — Guyana: Demerara, 2 ♂, IRSN. — Venezuela: Territorio Federal Amazonas, Sanariapo, 23 March 1957, 1 ♀, J. Rácenis leg. (No. JR-03098); Puerto Ayacucho, 15—21 November 1982, 1 ♂, A. Chacon & G. Yepez leg. (No. 14420); same locality, 21 November 1982, 1 ♂, G. Romero leg. (No. 14421); same locality, 28 October 1983, 1 ♀, J. Sanchez leg. (No. 14433), UCV.

The description of this species has been based on a single female. The holotype, formerly stored in the Museum of Copenhagen, is now in the Museum of Comparative Zoology at Cambridge, Massachusetts (MCZ type No. 12378). The female is dry pinned. The labels attached to the pin of the specimen are "Hagen" (white label, printed), "*fuliginosa*" (white label, written), "Essequibo, Schmidt" (white label, written), and "Type 12378" (red museum label, printed). I have added the pin label "*Phyllogomphoides fuliginosus* (Hagen *in* Selys, 1854) comb. nov. Holotype Rev. J. Belle, 1984".

The type specimen lacks the abdominal segment 8 with the specifically distinctive vulvar lamina. The tip of the abdomen (i.e. segments 9 and 10) is mounted on the label "Essequibo, Schmidt". The stylets (cerci) are broken off and glued onto the apical part of the ultimate segment but not in the original position. Nearly all hairs of the occipital ridge are broken off and lost. The hind wing (fig. 1) is 38 mm long, its greatest width 10.2 mm, and its pterostigma 6 mm (costal edge 5.6 mm). Other measurements are to be found in the Monographie des Gomphines under *audax*.

The labrum of the type has a pair of large, subtriangular yellow spots (fig. 20). The occipital ridge is slightly concave (fig. 38), and there is a large, yellow central spot on the rear of the occiput. The venation of the wings is blackish brown, including the frontal margin of the costae. The nodal index is 14 : 21—21 : 14/15 : 14—16 : 15 in fore and hind wings, respectively. The hind wings have a two-celled anal loop and the area posterior to vein Cu2 is four cells wide with an extra cell for a fifth row in the left hind wing. The veins Cu1 and Cu2 are slightly divergent towards the hind wing margin, i.e. there are three marginal cells between Cu1 and Cu2 in the left hind wing and four in the right.

In 1894, Selys gave descriptions (communicated by Mac Lachlan) of both sexes of *fuliginosus* (under the name *Gomphoides audax*), the descriptions being based on four males and one female from Guyana. After the descriptions he enumerated the differences between *fuliginosus* and *major* (under the names *Gomphoides audax* and *Gomphoides fuliginosa*, respectively). Belle (1970a) published illustrations of the male of *fuliginosus* (under the name *Phyllogomphoides audax*).

The two males in the Institut Royal des Sciences Naturelles at Brussels may have belonged to the Mac Lachlan collection. The pin labels of these males read "Demerara" and "*Gomphoides audax*? Hag. ♂". One of the males has moreover two pin labels "103".

Dimensions of *fuliginosus*. Males from Surinam: total length 65—69 mm; abdomen 50—53.5 mm (incl. app. 3.4 mm); fore wing 37—38 mm; hind wing 36—37 mm; greatest width of hind wing 10 mm; costal edge of pterostigma in fore wing 4.8—5.0 mm. For the males from Venezuela these numbers are 62—63; 49 (3.3); 34—35; 33—34; 9.5; 4.5—4.6. For the Venezuelan female from Sanariapa: 64; 51 (2.1); 38.5; 37; 10.2; 5.3. For the Venezuelan female from Puerto Ayacucho: 62; 49 (2.5); 36; 34.5; 9.6; 4.9. Thus we see that the specimens from Venezuela are somewhat smaller than those from Guyana and Surinam.

### **Phyllogomphoides audax**

(Hagen *in* Selys, 1854)
(figs. 2, 7, 11, 22, 39)

*Gomphoides audax* Selys, 1854: 75 (56 sep.) — ♀ Brazil. Selys & Hagen, 1858: 473, 474 (213, 214 sep.), pl. 11 figs. 6a—d (♀ occiput, genit. & apex abd.).

The description of this species has also been based on a single specimen. It is a female probably taken in Pará, Brazil (cf. Selys, 1894: 178 "sans doute du Para"). The species seems to be a rare gomphid, only the type being known so far. The holotype, stored in the Zoologisches Museum der Humboldt-Universität at East Berlin, is dry pinned. The pin labels are "2325" (white label, printed), "Type?" (red label, printed but question mark written), "Brasil" (green label, written), "*audax* Hag." (green label, written), "Zool. Mus. Berlin" (yellow label, printed; on reverse side written "I"), and "*Gomphoides audax* (Selys) Type?" (white label, written). The question marks are wrong since this female is the only known specimen of this species. I have added the pin label "*Phyllogomphoides audax* (Hagen *in* Selys, 1854) comb. nov. Holotype Rev. J. Belle, 1984".

The type specimen is in a fairly good condition. The colour pattern of the pterothorax is somewhat obliterated due to post mortem changes. The first pair of legs and the left second leg are missing. The right stylet (cercus) and the tip of the left stylet are broken off and lost. The lateral dilatations of the abdominal segment 8 are narrow, the width being only one-sixth the middorsal length of the segment (fig. 7). The labrum is largely yellow (fig. 22); in other members of the *fuliginosus* group with a pair of yellow spots. The occipital ridge is almost straight (fig. 39) and there is a large, yellow central spot on the rear of the occiput. The thoracic colour pattern is similar to that of *fuliginosus*. The venation of the wings is blackish brown, including the frontal margin of the costae. The nodal index is 12 : 21—21 : 13/13 : 16—15 : 13. The hind wings have the anal loop three-celled, the area posterior to vein Cu2 five to six cells wide, and the veins Cu1 and Cu2 markedly divergent towards the wing margin. The vulvar lamina (fig. 11) is rather small; its breadth is nearly one-third the width of the ninth sternum and its length is two-sevenths of the length of the ninth sternum. The posterior margin of the vulvar lamina is more or less excised U-shaped. The dimensions of the type are: total length 66 mm; abdomen 50 mm (incl. cerci); hind wing 43 mm; greatest width of hind wing 11.5 mm; costal edge of pterostigma in fore wing 6.0 mm. These measurements are in agreement with those given in the original description of 1854 and with those given in the Monographie des Gomphines of 1858 for *fuliginosus*. The smallest of both species is *fuliginosus* but the difference appears greater than a mere comparison of hind wing lengths might imply.

### Phyllogomphoides selysi (Navás, 1924)
### (figs. 4, 6, 10, 15, 21)

*Gomphoides selysi* Navás, 1924: 318, 319 (6, 7 sep.), fig. (♂ apex abd.) — ♂ Iquitos, Brazil.
*Gomphoides fuliginosa*; Needham, 1944: 195 (♀ Brazil).
*Phyllogomphoides selysi*; Belle, 1970b: 254, 255, fig. (♂ apex abd.).

Material. — Peru: Dept. Loreto, Amazon River, San Juan (near Iquitos), August 1939, 2 ♂ (one of them neotype), Jose Schunke leg. (purchased from Joseph Hocking), ANSP. — Brazil: Amazonas, Amazon River (300 miles below Iquitos), 1 ♀, USNM.

In 1924, Navás added a third member of the *fuliginosus* group, *selysi*, from Peru, basing his description on a single male collected in Pebas at the Amazon River. No new record has appeared in the literature until now. In the collection of the Academy of Natural Sciences of Philadelphia there are two similar Peruvian males from the nearby environment of Iquitos, the type locality of *selysi*. Prof. Westfall (Gainesville), who detected the gomphids in the Philadelphia Academy collection, has generously turned them over to me for study. They correspond closely with Navás' description and figure, except for the length of the insect and the length of the abdomen. Both lengths are about 8 mm greater for the present males. But the measurements given in that description, "Long. corp. 62.5 mm Long. abdom. 48 mm", are probably in error. It is virtually certain that one of the middle segments of the abdomen (which was obviously broken in fragments) was lacking or neglected during the measuring since the disparity in the length (8 mm) is about the length of each of these middle segments apart. Navás' *selysi* shows very close affinity with *fuliginosus* and the question arises even whether *selysi* should be considered a subspecies of *fuliginosus* or not.

Neotype designation of *Gomphoides selysi* Navás, 1924. — When I (Belle, 1970b) made a study of the Neotropical Gomphidae described by Navás, the holotype of *Gomphoides selysi* could not be re-examined because its location was unknown. Navás' collections at the Jesuit's Colegio de Salvador in Zaragoza were partly destroyed and the rest was divided up between the Colegio in Zaragoza and the Museo de Zoología at Barcelona (cf. Lieftinck, 1965: 56). The late Prof. Dr. B. Elwood Montgomery made a search for the types of Navás during his European trip of 1968. In the Barcelona Museum he succeeded in locating the types of four Neotropical Gomphidae out of five described by Navás but failed with the type of *selysi*. I have also written to the Museum of Zoology at Ann Arbor, Michigan, as Williamson had accumulated notes and drawings of types and specimens of *Phyllogomphoides* with the intention of monographing the genus. But in reply Mrs. Gloyd informed me that Navás' type of *selysi* had never been sent to Williamson for study. She kindly sent to me a xerox copy of a letter (dated December 15, 1931) to Williamson in which Navás wrote: "'J'ai décrit encore deux espèces: *Selysi* du Pérou et *Eugeniae* de l'Argentine; je ne les trouve plus. Je pense que le *Selysi* se trouve dans le Muséum de Paris..." When I visited the Paris Museum in 1977 I did not find any gomphid that recalled to this type. I therefore asked (June 17, 1983) Dr. Legrand to make a search for it. This he kindly did but he wrote me on August 31, 1983 that all his efforts remained ineffective. All in all, there is no reasonable hope that this type specimen is still extant. The close relationship between this species and *fuliginosus*, however, makes it advisable to stabilize the identity of *Gomphoides selysi* Navás, 1924. A neotype is therefore designated here. The specimen selected is one of the two males from Peru recorded above, with the features summarized below.

Dimensions: total length 72 mm; abdomen 56 mm (incl. caud. app. 3.6 mm); fore wing 44 mm hind wing 42 mm; costal edge of pterostigma in fore wing 5.9 mm.

Pale collar confluent with pale middorsal stripe and first pale antehumeral stripe. Thoracic colour pattern shaped as shown diagrammatically in fig. 15. Colour pattern of labrum similar to that of *fuliginosus*. Lateral dilatations of abdominal segment 8 very broad, the greatest width of these lateral dilatations one-third the middorsal length of the segment.

Venation of wings blackish brown but frontal margin of costae with a fine yellow line. Nodal index 15 : 21—22 : 16/16 : 16—16 : 14. Discoidal triangle and subtriangle three-celled in hind wings, four-celled in fore wings except for three-celled triangle of left fore wing. Hind wings with a two-celled anal loop, the veins Cu1 and Cu2 sub-parallel and the area posterior to Cu2 four (proximal) to five (distal) cells wide.

The distinguishing features of the other male are: dimensions as in neotype male but costal edge of pterostigma in fore wing 5.5 mm; pale collar not confluent with pale middorsal stripe and first pale antehumeral stripes narrowed at their conjunction with pale collar; venational characters of wings as in neotype but all discoidal triangles and subtriangles in fore wings four-celled; nodal index 14 : 21—20 : 14/15 : 16—15 : 15.

Female (first description; colours somewhat obliterated; tips of right wings broken off and lost; abdomen bristled, broken between segments 4 and 5; lateral leaf-like expansions of abdominal segment 8 eaten by tropical scavangers (fig. 6); right cercus broken off and lost). — Total length 72 mm; abdomen 56 mm (incl. cerci 3.2 mm); hind wing 43 mm; greatest width of hind wing 11.5 mm; costal edge of pterostigma in fore wing 5.8 mm.

Colour pattern resembling that of neotype male but pale markings on labrum more rounded (fig. 21), first pale antehumeral stripes not distinctly connected with pale collar, and pale marking of abdominal segment 7 extended on basal half of segment only.

Wings hyaline, venation dark brown including frontal margin of costae. Membrane of wings at base with brown patches reaching to just beyond arculus (patches better developed than in the present males). Discoidal triangle and subtriangle four-celled in fore wings, three-celled in hind wings. Supratriangle three-celled in fore wings, two-celled in hind wings. Nodal index 16 : 24—23 : 16/19 : 17—20 : 18. Second anal interspace of hind wings with two rows of cells but that of left hind wing with three marginal cells. Anal loop in hind wings two-celled. Cu1 and Cu2 in either hind wing very slightly diverging towards wing margin.

Vulvar lamina one-fourth as long as ninth sternum, at base two-thirds the width of eighth sternum, its posterior margin excised V-shaped; the lobes with projecting corners, the interval between lobes about 90° (fig. 10). Posterior margin of lateral dilatation of segment 9 with teeth. Stylet (cercus) somewhat longer than middorsal length of ninth segment, pale for its apical two-fifths.

*Ph. selysi* is stouter, more robust and larger than its nearest ally, *fuliginosus*. The difference in size is most striking. The consistent differences between the male caudal appendages of both species are very slight. The lateral leaf-like dilatations of the abdominal segment 8 are better developed than in *fuliginosus*, the greatest width of these expansions being one-third of the middorsal length of the segment, in *fuliginosus* only a quarter of the middorsal length of the segment. The two males have the first pale antehumeral stripes confluent with the pale collar, in *fuliginosus* they are not connected with the pale collar. And finally, the pale basal marking of the abdominal segment 7 reaches far beyond the submedian transverse groove, while in *fuliginosus* only to this groove. The female differs from *fuliginosus* in having the outer corners of the lobes of the vulvar lamina more produced.

### **Phyllogomphoides imperator** Belle, 1976

*Phyllogomphoides imperator* Belle, 1976: 197—200, figs. (♀ occiput, thorax, genit. & apex abd.) — ♀ San Fernando de Atabapo, Venezuela.

Mr. Cook wrote to me on February 3, 1983, that he had a male of *imperator* from El Inferno, Territorio Federal Amazonas, Venezuela. The male's colour pattern is essentially the same as that of the female holotype of this species with the second pale antehumeral stripe and the pale metepisternal stripe undeveloped. In conformation, the male inferior caudal appendage resembles that of *fuliginosus* and *selysi* by the presence of well-developed branches. These data were communicated by Mr. Cook, who has generously given me permission to use them to construct the key for the genus. A description of the male by him is in progress.

### **Phyllogomphoides praedatrix** Belle, 1982

*Phyllogomphoides praedatrix* Belle, 1982: 3—5, figs. (♀ thorax, genit., frons & apex abd.) — ♀ Abuná, Mato Grosso, Brazil.

### **Phyllogomphoides major** spec. nov.

(figs. 3, 8, 12, 23, 25, 40)

*Gomphoides fuliginosa*; Selys, 1894: 175—178 (♂ ♀ Guyana). Needham, 1944: 195—197 (♂ Surinam, sub *fuliginosus*), pl. 15 figs. 8a—d (♂ genit., app. & apex abd.). St. Quentin, 1967: 138.
*Negomphoides fuliginosa*; Rácenis, 1970: 25, 26 (♂ Venezuela), fig. (♂ apex abd.).
*Phyllogomphoides fuliginosus*; Belle, 1970a: 113—115, 118, 119, figs. (♂ app. & apex abd.; larval struct.), pls. 15a (♂ photogr. wings), 16a (photogr. exuviae). Geijskes, 1971: 665 (♂ French Guyana). St. Quentin, 1973: 343 (♂ Pará, Brazil, sub *fuliginosa*). Gloyd, 1973: 6. Donnelly, 1979: 247, 248.

Material (in addition to that recorded by Belle, 1970a under *fuliginosus*). — Guyana: Demerara, 2 ♂, IRSN. — Surinam: Surinam River, Aroesobanja Falls, 5 January 1959, 1 ♀ (in copula), J. Belle leg.; Kabalebo River, Avanavero (bank of river), 22 August 1973, 2 ♂, D. C. Geijskes leg., RNHL. — Venezuela: Bolívar, Canaima, 20 February 1958, 1 ♂, J. Rácenis leg.; T. F. Amazonas, Cacuri del Ventuari, 21 February 1959, 1 ♂, Cruxent et al. leg.; Bolívar, Río Paramichí, 9 January 1962, 1 ♂, Brewer leg.; Bolívar, Región Alto Caura, Cuchine (300 m), 11 April 1963, 1 ♂, 1 ♀; same locality, 12 April 1963, 1 ♂, all collected during Expedition La Salle; Bolívar, Kanarakuni (450 m), 3 February 1965, 1 ♂, Dr. Capriks leg.; T. F. Amazonas, Puerto Ayacucho, Estación de Piscicultura Fonaiap, 3 February 1983, 1 ♂, G. A. Romero leg.; Bolívar, Río Caroní, San Francisco de Las Babas, 7—13 April 1983, 1 ♂, J. de Marmels leg., UCV.

In 1894, Selys published descriptions (communicated by MacLachlan) of both sexes of *major* (under the name *Gomphoides fuliginosa*), based on four males and one female taken in Guyana. Needham (1944) redescribed in length and illustrated the male of *major* (under the name *Gomphoides fuliginosa*), basing his description on seven males from adjoining Surinam. Belle (1970a) gave illustrations of the adult male and a description of its larva from a reared female under the name *Phyllogomphoides fuliginosus*, all after specimens from Surinam.

In size, *major* can be compared with *audax* but the females of these species show striking differences. The veins Cu1 and Cu2 of the hind wings are sub-parallel in *major*; they diverge markedly towards the wing margin in *audax* (figs. 2, 3). The lateral leaf-like dilatations of abdominal segment 8 of *major* are much better developed than those of *audax*. The greatest width of these expansions is nearly half the middorsal length of segment 8; in *audax* only one-sixth the middorsal length of segment 8 (figs. 7, 8). The labrum of *major* has the usual symmetric pair of yellow spots, while that of *audax* is largely yellow (figs. 22, 23). The male of *audax* is unknown but I think that it will present the same characteristics.

The chosen holotype of *major* is a male labeled "Surinam", "Surinam River, Gansee, 27 Sept. 1957, J. Belle leg.", and "*Phyllogomphoides major* spec. nov. Holotype ♂ Det. J. Belle, 1984". It is in the author's collection but eventually will be deposited in the Rijksmuseum van Natuurlijke Historie at Leiden together with all other types in his collection.

Some features of the holotype are: total length 77 mm; abdomen 58.5 mm (incl. caud. app. 4 mm); fore wing 45.5 mm; hind wing 44 mm; greatest width of hind wing 6.5 mm; costal edge of pterostigma in fore wing 6.3 mm. Venation of wings brown but frontal margin of costae yellow at base of wings. Discoidal triangle and subtriangle four-celled in fore wings, three-celled in hind wings. Supratriangle three-celled in fore wings, two-celled in hind wings. Nodal index 15 : 23—25 : 15/19 : 16—18 : 17. Hind wings with a four-celled (right) and five-celled (left) anal triangle, with a two-celled anal loop, with area posterior to Cu2 four to five cells wide, and with two marginal cells between Cu1 and Cu2 in either wing.

The males from Guyana may also have belonged to the MacLachlan collection. They have the pin labels "B. Demarara" and "*Gomphoides fuliginosa* Hag. ♂". One of the males moreover has two pin labels "102".

The other specimens formerly recorded by me under the name *Phyllogomphoides fuliginosus* (cf. Belle, 1970a) as well as the present ones should be considered paratypes. The superior caudal appendages of the males from Venezuela have the subapical, superior inner strip and the inferior inner tooth at one-third length generally longer and more acuminate than those of the males from Surinam.

### CRISTATUS GROUP

The species *cristatus* does not fit satisfactorily into any of the groups discussed in this paper. It is classified here as a separate group. *Phyllogomphoides cristatus* resembles several other species of the genus but it is aberrant in the male caudal appendages by the simplified structure of the superiors which lack any protuberance, and by the extremely reduced inferior. The penis resembles that of the *fuliginosus* group but the apical margin of the truncate cornua is not concave. The larva of this group and that of the *andromeda* group and *undulatus* group, discussed below, has the inner margin of the lateral labial lobe armed with a few blunt teeth.

*Phyllogomphoides cristatus* is known only from Surinam.

### **Phyllogomphoides cristatus** (Needham, 1944) (fig. 26)

*Gomphoides cristatus* Needham, 1944: 202—204, pl. 15 figs. 10a—c (♂ genit. & apex abd.) — ♂ Paroe River, Surinam. Calvert, 1948: 65, 66. Lieftinck, 1971: 82.

*Phyllocycla (Cyclophylla) cristatus*; St. Quentin, 1967: 142; 1973: 346 (key).

*Negomphoides cristatus*; Belle, 1970a: 126—130, figs. (♂ ♀ apex abd.; ♀ 3rd femur; larval struct.), pls. 17b (♂ photogr. wings), 18a (♀ photogr. wings), 21a (photogr. exuviae); 1982: 2.

*Phyllogomphoides cristatus*; Gloyd, 1973: 6.

Only the location of the right pair of wings of the male holotype of this species is known. According to Needham (1944) the type should be in the Academy of Natural Sciences of Philadelphia, but the staff of this institution was not able to locate it (Dr. Emsley 1966, pers. comm.). As Needham made his studies of 1944 in the Cornell University, Ithaca (New York), I wrote to Prof. Pechuman for information. He kindly made a search for the type in the Cornell collections and on August 17, 1982 informed me as follows: "*Gomphoides cristatus*. C.U. Type No. 3070. ♂ holotype, 2 wings only; probably Needham returned the rest of the specimen to Philadelphia; there is no locality data on slide with wings. ♀ allotype in an envelope; in our type book it is noted you saw the ♀ allotype and said it was *undulatus*". I have also asked Prof. Westfall (Gainesville) for the whereabouts of the type and he kindly replied on November 9, 1982: "I had no record of any specimen of *Gomphoides cristatus* Needham, 1944, in my notes. I have a list of all the type specimens in the Philadelphia Academy collection when I was there and the name does not appear in that list. I also made a list of the species represented in the collection and it is not there."

### *ANDROMEDA* GROUP

This group is composed of the three species *andromeda*, *cassiopeia* and *cepheus*. The feature possessed in common is the more or less tweezers-shaped conformation of the male superior caudal appendages.

The wide range of *andromeda* is very striking; it covers the area from the northern coast of South America to the northern regions of Argentina. The distribution of the other two members of the group seems to be restricted to Paraguay and the Brazilean State of Mato Grosso.

### **Phyllogomphoides andromeda** (Selys, 1869) (fig. 28)

*Cyclophylla andromeda* Selys, 1869: 194, 195 (31, 32 sep.) — ♀ Caripi, Pará, Brazil. Calvert, 1948: 66 (*andromache* lapsus pro *andromeda*).

*Phyllocycla andromeda*; St. Quentin, 1973: 346, 347 (key; ♂ Goiás, Brazil).

*Negomphoides andromeda*; Belle, 1970a: 145—150 (♂ ♀ Surinam), figs. (♂ thor., occiput, genit. & app.; ♂ ♀ apex abd.; larval struct.), pls. 19b (♂ photogr. wings), 20a (♀ photogr. wings), 21c (photogr. exuviae). Geijskes, 1971: 665 (♂ ♀ French Guyana). Lieftinck, 1971: 73.

*Phyllogomphoides andromeda*; Gloyd, 1973: 6. Belle, 1977: 291 (sub *andromedae*). Jurzitza, 1981: 117 (Argentina, sub *andromedae*). Belle, 1982: 2 (sub *andromedae*).

Material. — Argentina: Missiones, Parque Nacional Iguazú, Apepú, 22 January 1979, 1 ♀ (AC), 3 ♀; 20 February 1979, 1 ♂, all G. Jurzitza leg. CJ. — Brazil: Pará, Rio Tapajós, Itaituba, April 1921, 2 ♂, 1 ♀, A. H. Fassl leg., SMF. — Surinam: Coppename River, Raleigh Falls (on light), 7 March 1972, 1 ♀, D. C. Geijskes leg., RNHL. — Venezuela: T. F. Amazonas, Piedras Pintadas, 8 March 1957, 1 ♂ (teneral), J. Rácenis leg., UCV (No. JR—13219).

The present female from Surinam has the subtriangle in the right hind wing two-celled; the subtriangle in the hind wings of this species is normally open.

### **Phyllogomphoides cassiopeia** (Belle, 1975)

*Gomphoides cassiopeia* Belle, 1975: 129—133, figs. (♂ occiput, thor. & app.; ♀ genit.; ♂ ♀ apex abd.) — ♂ ♀ San Pedro, Paraguay.

*Phyllogomphoides cassiopeiae*; Belle, 1980: 177.

### **Phyllogomphoides cepheus** Belle, 1980

*Phyllogomphoides cepheus* Belle, 1980: 176—180, figs. (♂ head, dorsum thor. & app.; ♂ ♀ apex abd.) — ♂ ♀ Sinop, Mato Grosso, Brazil.

### *UNDULATUS* GROUP

This group is made up of the six species *un-*

*dulatus, atlanticus, aculeus, angularis, pedunculus,* and *pseudoundulatus*. The feature possessed in common, which permits recognition of the group, is the possession of a long, thin basal spine at the inferior margin of each male superior caudal appendage.

The group is chiefly Amazonian in its distribution but two members, *undulatus* and *atlanticus*, also occur in the northern coastal area of South America.

### **Phyllogomphoides undulatus** (Needham, 1944) (figs. 16, 29)

*Gomphoides undulatus* Needham, 1944: 199—201, pl. 15 figs. 9a—e (♂ genit., app. & apex abd.), 203, 204 (♀, under *Gomphoides cristatus*, cf. Belle, 1970a: 126) — ♂ ♀ Litani River, Surinam; ♂ Mapaoni River, Territorio do Amapa, Brazil. Geijskes, 1964: 40, 41, fig. (♀ apex abd.). St. Quentin, 1973: 344 (key; ♂ ♀ Pará, Brazil). Lieftinck, 1971: 118.

*Negomphoides undulatus*; Belle, 1970a: 131—133, figs. (♂ app. & apex abd.; ♀ 3rd femur; larval struct.), pls. 18b (♂ photogr. wings), 19a (♀ photogr. wings), 21b (photogr. exuviae); 1972: 236.

*Phyllogomphoides undulatus*; Gloyd, 1973: 6. Belle, 1977: 291. Kiauta, 1979: 268, 269. Belle, 1982: 2.

### **Phyllogomphoides atlanticus** (Belle, 1970)

*Negomphoides atlanticus* Belle, 1970a: 133—136, figs. (♂ occiput, genit., app. & apex abd.), pl. 20b (♂ photogr. wings) — ♂ Coppename River & Brownsberg, Surinam. Lieftinck, 1971: 76.

*Gomphoides atlanticus*; St. Quentin, 1973: 344 (key).

*Phyllogomphoides atlanticus*; Gloyd, 1973: 6.

### **Phyllogomphoides aculeus** Belle, 1982

*Phyllogomphoides aculeus* Belle, 1982: 5—8, figs. (♂ thor., genit. & app.) — ♂ Iquitos, Peru.

### **Phyllogomphoides angularis** Belle, 1982

*Phyllogomphoides angularis* Belle, 1982: 8—11, figs. (♂ thor., genit. & app.) — ♂ Porto Velho, Amazonas & Belém, Pará, Brazil.

### **Phyllogomphoides pedunculus** spec. nov. (figs. 18, 33—36)

*Gomphoides atlanticus*; St. Quentin, 1973: 345.

Material. — Brazil: Amazonas, Rio Uaupés, Taraquá, 18 August 1964, 1 ♂ (holotype), Machado & Pereira leg., CM.

The specimen here recorded is No. 78 of St. Quentin (1973), who provisionally placed it under *atlanticus*. In fact the male belongs to a new species which is very closely related to *angularis*. It differs from *atlanticus* and agrees with *angularis* by the uncrossed subtriangle in the hind wings (fig. 34) and in having the posterior margin of the anterior hamules armed with an acute hook (fig. 35). It differs from *angularis* in having the first pale antehumeral stripes not confluent with the pale collar and in having the penial peduncle (seminal vesicle) excessively elongated being about half as long as the second abdominal segment (fig. 36); it is only one-third the length of the second abdominal segment in *angularis*. The superior caudal appendages are not curved so very strongly mesad as in *angularis* (fig. 33).

Male (holotype; thorax partly crushed; legs broken off except for the right third leg; abdomen broken between segments 3 and 4). — Total length 52 mm; abdomen 39.5 mm (incl. caud. app. 2.0 mm); hind wing 30 mm; costal edge of pterostigma in fore wing 4.0 mm.

A brown species marked with green, resembling *angularis*.

Head brown, the following green: a large oblong spot on each side of labrum, basal half of mandibles externally, anteclypeus, lateral sides of postclypeus, and superior surface of frons for its anterior half.

Prothorax with a middorsal pale twin-spot on middle lobe. Thoracic colour pattern shaped as shown diagrammatically in fig. 18.

Tibiae, tarsi and claws black. Lamina tibialis of first tibiae one-third the tibial length.

Wings hyaline but extreme bases very slightly flavescent. Wing venation blackish brown but frontal margin of costae proximal to nodus with a very fine yellow line. Nodal index 11 : 19—20 : 12/13 : 15—15 : 11. Cubito-anal interspace of either fore wing with an extra cross-vein at level of arculus. Anal triangle in hind wings made up of four (right) and five (left) cells.

Abdomen predominantly dark brown, the pale markings green on basal segments, yellow on other segments. Segments 1 to 6 with a pale middorsal line which becomes very fine on apex of 5 and on 6. Sides of 1 and 2 pale. Sides of 3 to 6 with pale basal spots which become shorter on rear segments, successively, reaching to a point three-quarters the way along the segment on 3, and to a point a quarter the way along the segment on 6. Base of 7 pale to submedian transverse groove.

Accessory genitalia and caudal appendages shaped as shown in accompanying figures. Genital hamules pale, the chitinized tip of the hooks brown. Penial peduncle brown, its posterior margin deeply cleft and with a strong median tooth on the bottom of the cleft. In profile, the apical segments of the abdomen, including the caudal appendages, are very similar to those of *angularis*.

### Phyllogomphoides pseudoundulatus
spec. nov.
(fig. 17)

Material. — Brazil: Pará, Rio Tapajós (Cachoeira I), May 1920, 1 ♂ (holotype), A. H. Fassl leg., SMF.

The resemblance between this species and *undulatus* is so strong that on a superficial view they can easily be confused. With the exception of the penile organs, the morphological differences are very slight and they can better be stated by direct comparison than by description. The new species, here introduced under the specific name *pseudoundulatus*, is somewhat smaller and more delicate than *undulatus*. The cornua of the penis, when pressed close to the venter of the abdomen, reaches to a point half-way between the base and the submedian transverse groove of the third abdominal segment; in *undulatus* to a point on level with these grooves. The lateral dilatations of the abdominal segments 8 and 9 are twice as narrow as those in *undulatus*. The superior caudal appendages of both species are very similar in configuration but those of *pseudoundulatus* are a trifle more slender. The most striking difference in the coloration is found on the thoracic dorsum. In *pseudoundulatus* the first pale antehumeral stripe is wide and broadly confluent with the pale collar, while in *undulatus* it is narrow and does not reach the pale collar (figs. 16, 17).

Male (holotype; head partly and thorax completely hollowed out by scavangers; thoracic colour pattern largely obliterated by post mortem changes; fragmented). — Total length 53 mm; abdomen 41 mm (incl. caud. app. 2.1 mm); hind wing 28 mm; costal edge of pterostigma in fore wing 3.5 mm.

A brown specimen with pale markings, seemingly yellow originally.

Face brown. Labrum with nondescript lighter markings (in *undulatus*, black with a symmetric pair of green spots). Base of mandibles pale. Vertex dark brown. Occipital plate brown.

Prothorax blackish brown. Thoracic colour pattern shaped something like in fig. 17. Thoracic dorsum dark brown with broad pale stripes. Sides of pterothorax largely pale. Brown midlateral stripe partly developed. Brown femoral stripe indistinct.

Ventral side of femora pale (in *undulatus*, the ventral side of the second and third pair of femora is blackish brown). Lamina tibialis of first tibiae one-third the tibial length.

Flavescence at extreme bases of wings less developed than in *undulatus*. Reticulation of wings less dense than in *undulatus*. Nodal index 13 : 18—17 : 10/12 : 13—13 : 12.

Abdomen predominantly dark brown, almost black on middle segments. Segments 1 and 2 similar to those of *undulatus* but segments 3 to 7 lacking pale dorsobasal markings. Instead, the sides of 3 are largely pale, medially interrupted by black, and the sides of 4 are pale at both ends only.

### *SEMICIRCULARIS* GROUP

The species composing this large group are very nearly allied inter se. Most of its members occur in Central America. Three species, viz. *semicircularis*, *lieftincki* and *brunneus*, belong to the fauna of South America. However, there is always a possibility that members known hitherto from Central America turn up in Colombia, and conversely. Features possessed in common and not encountered elsewhere in the genus include the semicircular form of the male superior caudal appendages and the crenate inner margin of the lateral labial lobes of the larva.

The range of this group covers the whole area of Central America and the northwestern part of continental South America, southward to Bolivia.

### Phyllogomphoides semicircularis (Selys, 1854)
(fig. 30)

*Gomphoides semicircularis* Selys, 1854: 75, 76 (56, 57 sep.) — ♂ "South America". Selys & Hagen, 1858: 469, 475, 476, 686 (209, 215, 216, 426 sep.), pl. 12 figs. 1a—g (♂ occiput, genit., app. & apex abd.). Fraser, 1940: pl. 6 fig. 5 (penis; cf. Belle, 1970a: 154; 1982: 13). St. Quentin, 1967: 139, 150; 1973: 344 (key).

*Negomphoides semicircularis*; Belle, 1970a: 152—155, figs. (♂ thorax, genit., app. & apex abd.).

*Phyllogomphoides semicircularis*; Gloyd, 1973: 6. Belle, 1982: 2, 3, 11—14, figs. (penis; ♀ genit.; ♂ ♀ Colombia, Venezuela. Erratum: 13, line 12 from top: "eastern" should read "western").

### **Phyllogomphoides lieftincki** (Belle, 1970)

*Negomphoides lieftincki* Belle, 1970a: 154—158, figs. (♂ thorax, app. & apex abd.; ♂ ♀ genit.) — ♂ ♀ Tingo María, Huallaga River & Mishuyacu, Peru; ♂ ♀ Chácara, Bolivia. Lieftinck, 1971: 97. Belle, 1972: 236, figs. (♂ dorsum thorax).
*Gomphoides lieftincki*; St. Quentin, 1973: 344 (key).
*Phyllogomphoides lieftincki*; Gloyd, 1973: 6.

Material. — Bolivia: Dept. Santa Cruz, Buenavista (400 m), November 1930, 2 ♂, Fr. Steinbach leg., UMAA. — Peru: Dept. Huánuco, Shapajilla (630 m), 22 July 1938, 1 ♂, Felix Woytkowski leg., UMAA; Dept. Huánuco, Tingo Maria, November 1949, 1 ♂, H. A. Allard leg., USNM; Dept. Junín, Prov. Jauja, District Andamarca, Satipo (750 m), January 1937, 1 ♂, K. Meskendahl leg., ZMUH; same locality, no date, 1 ♂; April (no year), 1 ♂; June 1941, 1 ♂; May 1945, 2 ♂; June 1945, 1 ♂; May 1947, 1 ♂, all Pedro Paprzycki leg.; Dept. Junín, La Merced, Hda "La Salud" (3500′), no date (no date on field envelope, but date on others in same purchase are for March & June 1931. Rec'd VIII-1943, *via* Pacific Coast Biol. Serv. L. K. Gloyd), 2 ♂, Juan de Rivas S. leg.; Dept. Junín, Sani Beni (840 m; 8 km east of Satipo), 9 December 1935, 1 ♀, Felix Woytkowski leg., UMAA.

### **Phyllogomphoides brunneus** (Belle, 1981)

*Phyllogomphoides brunneus* Belle, 1981: 173—176 (♂ thor., apex abd., genit., app. & wings; ♀ genit.) — ♂ ♀ Macas & Limóncocha, Ecuador. Belle, 1982: 13.

Material. — Ecuador: Napo-Pastaza, C-Z trail, between Campamento & Zatazyacu [From Macintyre's letters, this locality would seem to be not far from El Partidero. L. K. Gloyd], 4 August 1935, 1 ♀; Napo-Pastaza, Puyo, 16 March 1957, 1 ♂ (teneral), both William Clarke-Macintyre leg., UMAA; Santiago-Zamora, Zumbi, Río Zamora (Elev. 700 m, ca. 3°50′ S, 78°26′ W), 25 October 1941, 1 ♂, UMAA; same locality, 29 October 1941, 1 ♂ (AC), both David B. Laddey leg. — Venezuela: Tachira, Río Negro, 11—13 December 1980, 1 ♂, J. de Marmels leg., UCV.

*Phyllogomphoides brunneus* hitherto was known from Ecuador only; its discovery in Venezuela extends the range of this species considerably eastwards.

The colour design of the thoracic dorsum varies greatly in this species. The male from Venezuela has the first pale antehumeral stripes cuneiform and broadly confluent with the pale collar. The second pale antehumeral stripes are reduced to a dorsal spot, a kind of reduction also observed in the related congeners *semicircularis* and *lieftincki* (cf. Belle, 1970a: 157; 1972: 231; and 1982: 14).

The Ecuadorian male and female from Napo-Pastaza have completely undeveloped second pale antehumeral stripes, while the first pale antehumeral stripes are not connected with the pale collar. The pale collar and antehumeral stripes are weakly developed in the female, and they are about twice as narrow as those in the male.

One of the males from Santiago-Zamora is stored in a triangular envelope with the field note: "Sometimes found in deep woods, away from water, D.B.L.".

### *CALVERTI* GROUP

In this group I place the two very closely related species *calverti* and *camposi*. The most striking features in common are the fundamental similarity in the form of the male superior caudal appendages and the penis. Each superior caudal appendage has two inferior processes on the proximal half while the preputial fold of the penis (c.f. Fraser, 1940: 544) is much produced ventrally (figs. 31, 32).

Tentatively I place *singularis* in this group as well. I have long hesitated about its classification as the male abdominal terminalia are unknown. But judging from the conformation of the accessory genitalia, *singularis* seems to fit best into the *calverti* group. This disposition may later be confirmed when better material becomes available.

The distribution of *camposi* is remarkable in that it occurs in the western part of the Andean Cordilleras while the other two members of the group are known from the Amazon and eastern Bolivia. Apparently the Andean watershed offers no barrier to the spread of the group.

### **Phyllogomphoides calverti** (Kirby, 1897)
(fig. 31)

*Cyclophylla calverti* Kirby, 1897: 613, 614, pl. 12 fig. 2 (♂ whole insect) — ♂ Pará, Brazil. Kimmins, 1969: 292.
*Gomphoides calverti*; Campion, 1920: 134—136, 141, pl. 6 figs. 6, 7 (♂ apex abd. & penis). Fraser, 1940: pl. 6 fig. 6 (penis).
*Phyllocycla calverti*; St. Quentin, 1973: 346 (key).
*Phyllogomphoides calverti*; Gloyd, 1973: 6.

### **Phyllogomphoides camposi** (Calvert, 1909)
(fig. 32)

*Gomphoides camposi* Calvert, 1909: 219—221, pl. 7 fig. 127 (♂ apex abd.) — ♂ Quevedo, Ecuador. Campion, 1920: 134—136, 141, pl. 7 figs. 8, 9 (♂ genit.). Campos R., 1922a: 2, 31; 1922b: 86 (Palenque & Quevedo, Ecuador). Navás, 1916: 71 (key).

*Phyllocycla (Cyclophylla) camposi*; St. Quentin, 1973: 346 (key).

*Phyllogomphoides camposi*; Gloyd, 1973: 6.

### **Phyllogomphoides singularis** Belle, 1979

*Phyllogomphoides singularis* Belle, 1979: 39—41, figs. (♂ thorax, 3rd tibia, genit. & detail wing) — ♂ Todos-Santos, Bolivia.

### *ANNECTENS* GROUP

This group is composed of two closely linked species, *annectens* and *regularis*. The two important features shared by these species are also the fundamental similarity in the form of the male caudal appendages and the penis. Each male superior caudal appendage has a strong inferior tooth at the extreme base. The penis is peculiar in having the stem provided with an obtuse apical, dorsal spine, in having the median segment unusually stout and the cornua broad and grooved (fig. 27).

The range of this group seems to be restricted to the eastern regions of the South American highland.

### **Phyllogomphoides annectens** (Selys, 1869)

*Gomphoides ? annectens* Selys, 1869: 192, 193 (29, 30 sep.) — ♂ Nova Friburgo, Rio de Janeiro, Brazil. Calvert, 1905: 152.

*Gomphoides annectens*; Selys, 1873a: 766 (38 sep.); 1873b: 506 (62 sep.). Calvert, 1909: 221. St. Quentin, 1973: 344, 345 (key; ♂ Minas Gerais, ♂ ♀ Paraiba, ♂ Parana, ♀ Mato Grosso).

*Cyclophylla (Phyllocycla) annectens*; St. Quentin, 1967: 140, 141, figs. (♂ thorax, genit. & app.; ♀ genit.; ♂ ♀ Rio Grande do Sul); 1973: 344 (key).

*Negomphoides annectens*; Belle, 1970a: 138—141, figs. (♂ genit. & app.; ♂ Santa Catarina).

*Phyllogomphoides annectens*; Gloyd, 1973: 6. Donnelly, 1979: 261. Belle, 1982: 1.

Material. — Brazil: Rio Grande do Sul, no date or collector, 1 ♀, NHMV.

This species was decribed after two males as may be apparent from the measurements given in the original description "Abdomen 44—46. Aile inférieure 37—38". In the Selysian collection in Brussels there are three specimens placed under *Gomphoides annectens*: (1) a male in fairly good condition; it was selected as the lectotype by me (cf. Belle, 1970a); (2) a male, lacking the abdomen, with the labels "P Br" (green label), "*Cyclophylla* ? *annectens*. De Selys a renvoyer" (an old label in Selys' handwriting), "det. Selys *Gomphoides annectens* Selys" (a recent white label in an unknown handwriting), and "Paratypus" (red museum label); (3) a female, lacking the apical half of the abdomen, with the labels "Para schl." (green label), "*Gomph. annectens*" (an old label in Selys' handwriting), and "Paratypus" (red museum label). This specimen was called the allotype female of *Gomphoides annectens* by St. Quentin (1967: 141). The female, however, belongs to the genus *Aphylla* Selys.

The male lectotype of *annectens* is peculiar in having the end segments of the abdomen densely covered with rather long, stiff hairs.

### **Phyllogomphoides regularis** (Selys, 1873)
(figs. 13, 19, 27, 37)

*Gomphoides regularis* Selys, 1873a: 765, 766 (37, 38 sep.) — ♂ ♀ Carrancas, Minas Gerais, Brazil. Navás, 1916: 71 (key). St. Quentin, 1973: 344 (key).

*Cyclophylla (Phyllocycla) regularis*; St. Quentin, 1967: 133.

*Negomphoides regularis*; Belle, 1970a: 141—145, figs. (♂ app.; ♂ ♀ genit.; ♀ apex abd.; ♂ ♀ Santa Catarina).

*Phyllogomphoides regularis*; Gloyd, 1973: 6. Donnelly, 1979: 261. Belle, 1982: 1.

Material. — Brazil: Rio Grande do Sul, no date or collector, 1 ♀, NHMV. Brazil ? : 1 ♀ (teneral), Scheider (Berlin) leg., SMF.

The examples of this species recorded from Santa Catarina by me (Belle, 1970a) differ from those of Minas Gerais in having the prothorax entirely dark brown, whereas in the (type) specimens from Minas Gerais the prothorax is largely pale with dark brown markings on the middle lobe only. But the most striking difference is found in the thoracic colour pattern which in the specimens from Santa Catarina is composed of black, brown and white-green stripes (fig. 19). This colour difference between the thoracic stripes is also observed in *annectens* but in less degree.

The present female from "Brazil ?" has the same coloration as the (allotype) female from Minas Gerais. The female from Rio Grande do Sul was referred to *annectens* by St. Quentin but is referable to *regularis* since the end segments of the abdomen are scarcely provided with hairs, a character displayed by the male holotype and female allotype of *regularis*. The pterothorax of the female from Rio Grande do Sul is completely eaten out by scavengers, while the thoracic colour pattern cannot sufficiently be studied because it is largely obliterated. St. Quentin's figure 5d of its vulvar lamina is quite misleading. The excision is in fact much deeper. The configuration of the vulvar lamina of this female is as shown by my camera lucida drawing fig. 13.

### *CORNUTIFRONS* GROUP

The position of the sole member of this group, *cornutifrons*, is not clear as long as the male sex of this species is unknown. The peculiar characteristic of the female, viz. the presence of a pair of large horns on the top of the frons, has led me to keep this species in a separate group.

*Phyllogomphoides cornutifrons* is known only from the isle of Trinidad.

### **Phyllogomphoides cornutifrons**
(Needham, 1944)

*Aphylla cornutifrons* Needham, 1944: 194, 195, pl. 14 fig. 6 (♀ frons) — ♀ Tunapuna, Trinidad.
*Negomphoides cornutifrons*; Belle, 1970a: 150, 151, figs. (♀ frons, apex abd. & 3rd femur).
*Phyllogomphoides cornutifrons*; Gloyd, 1973: 6.

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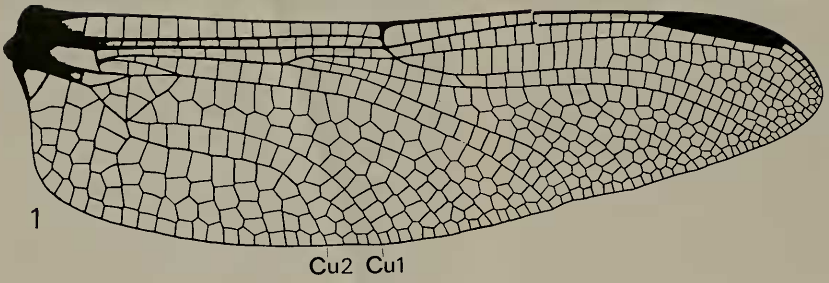

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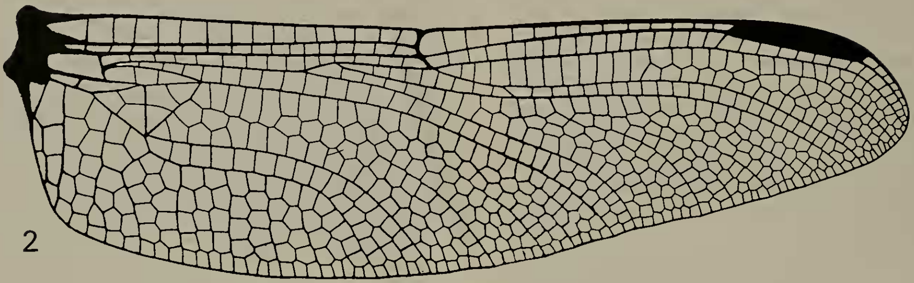

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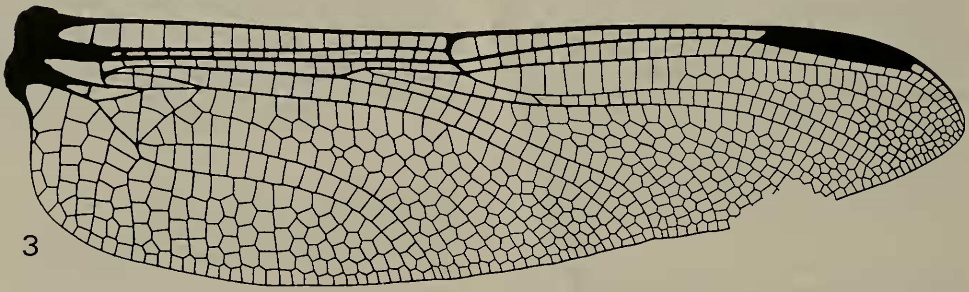

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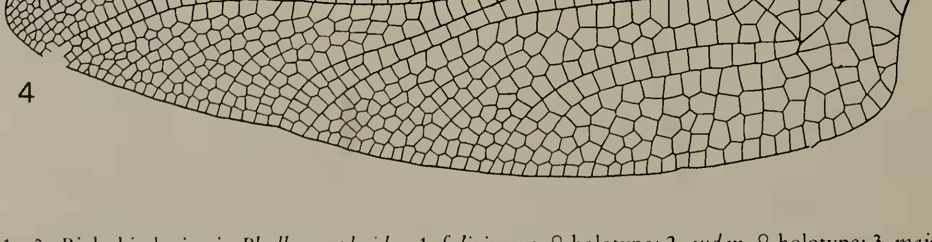

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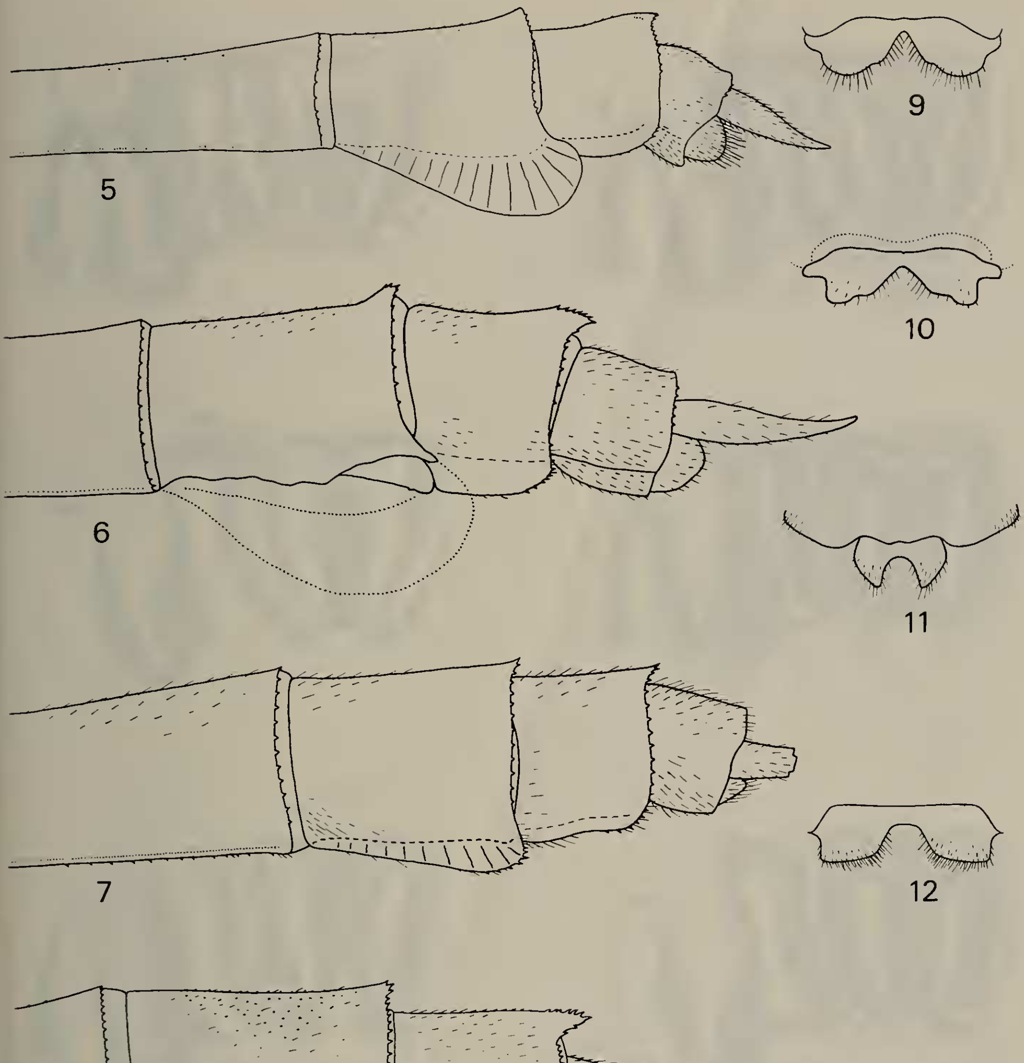
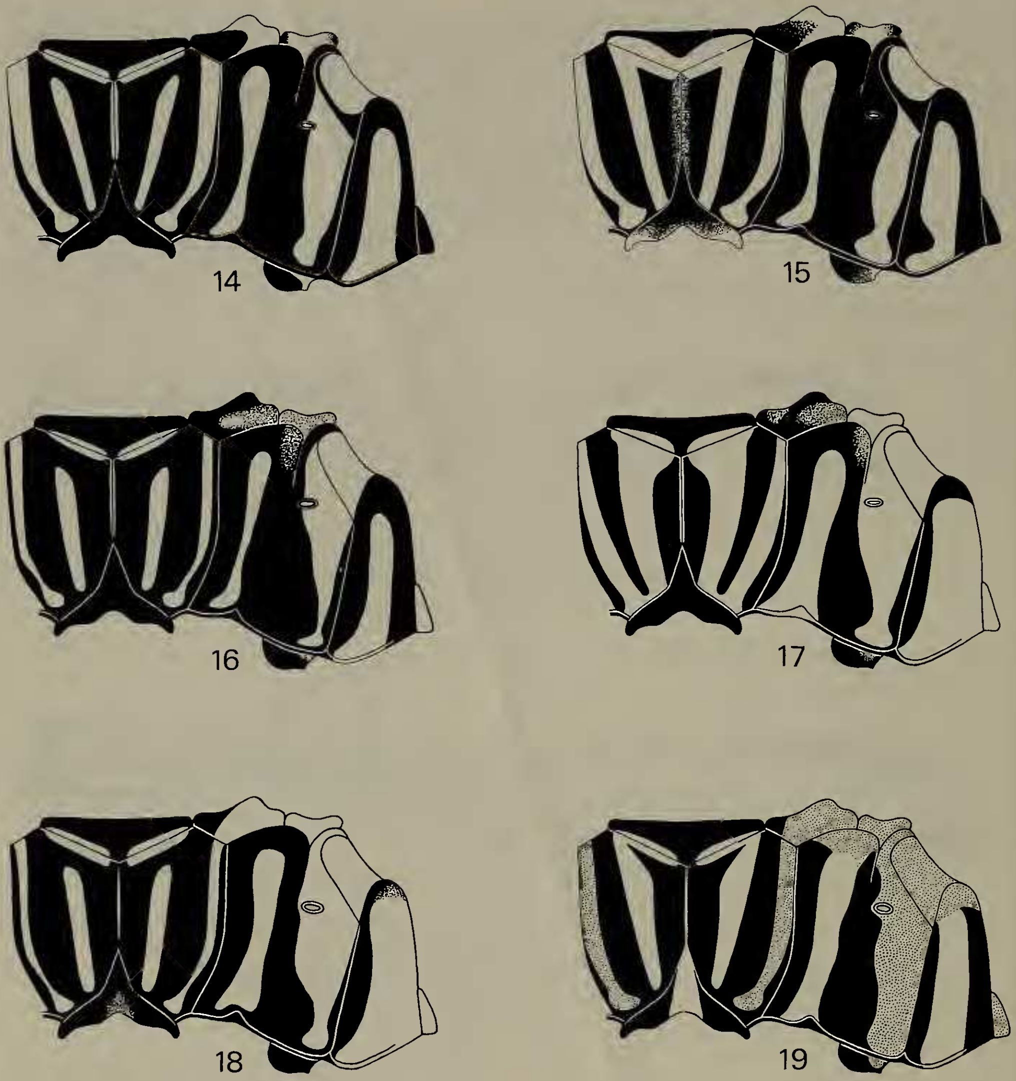
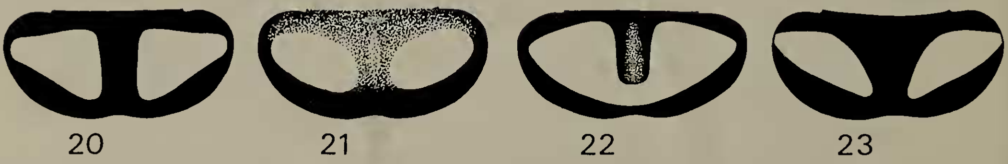
Figs. 1—3. Right hind wing in *Phyllogomphoides*: 1, *fuliginosus*, ♀ holotype; 2, *audax*, ♀ holotype; 3, *major*, ♀ allotype. Fig. 4. Left hind wing of first described ♀ of *Phyllogomphoides selysi*.



Figs. 5—8. Left profile view of apical segments of abdomen in *Phyllogomphoides*: 5, *fuliginosus*, ♀ Venezuela; 6, *selysi*, first described ♀ (possible outline of dilatation indicated by dotted line); 7, *audax*, ♀ holotype; 8, *major*, ♀ allotype. Figs. 9—13. Ventral view of vulvar lamina in *Phyllogomphoides*: 9, *fuliginosus*, ♀ Venezuela; 10, *selysi*, first described ♀; 11, *audax*, ♀ holotype; 12, *major*, ♀ allotype; 13, *regularis*, ♀ Rio Grande do Sul, Brazil.





Figs. 14—19. Thoracic colour pattern in *Phyllogomphoides*: 14, *fuliginosus*, ♀ Venezuela; 15, *selysi*, ♂ neotype; 16, *undulatus*, ♂ Surinam; 17, *pseudoundulatus*, ♂ holotype; 18, *pedunculus*, ♂ holotype; 19, *regularis*, ♂ Santa Catarina, Brazil. Figs. 20—23. Colour pattern of labrum in *Phyllogomphoides*: 20, *fuliginosus*, ♀ holotype; 21, *selysi*, first described ♀; 22, *audax*, ♀ holotype; 23, *major*, ♀ allotype.